SCIENCE.

FRIDAY, AUGUST 22, 1884.

COMMENT AND CRITICISM.

MEMBERSHIP in the American association for the advancement of science is readily attainable by any one willing to pay a small annual fee, and it is largely affected by the localities which it visits in its annual peregrination. So many sections of the northern half of the United States have already been visited, that one would suppose the membership would now fairly represent the distribution of interest in science throughout the country; though for various reasons, and particularly because the association has never, at least in recent years, met there, one would expect a feeble showing from the southern and Pacific states.

An inspection of the list of present members shows, however, some curious anomalies. The total number of members is 2,011. The cities having the largest number of members are New York (153), Boston (142), Cincinnati and Washington (127 each). The next highest is Montreal (71), where the meeting was held two years ago, which distances Philadelphia (51), which, in its turn, is scarcely ahead of St. Louis (49) and Cambridge (47). New Haven (30), with all its scientific activities, is not so far beyond Hartford (19) as we should expect. Chicago shows a meagre number (26), and is surpassed by Baltimore (28). Salem, as the nominal headquarters of the association, hardly responds with credit (20), while Minneapolis (31) surpasses Chicago and Baltimore. Providence (15), where the association has not met since 1855, makes a better showing than Indianapolis (7), where it met in 1871; or Dubuque (1), 1872; or Detroit (6), 1875; or Buffalo (12), 1876. Several of these are surpassed by New Orleans (10), near which the association never ventured, and by San Francisco (6), still farther removed from its activities; while Charleston, where the association met in 1850, finds no representation whatsoever.

More than one-third of the association come from New York (349) and Massachusetts (341). Ohio (208) comes next, followed by the District of Columbia (129), Canada (120), and Pennsylvania (111). No other states furnish more than 100 members; but it is unexpected to see Connecticut (73) neck and neck with Missouri (72); Rhode Island (29) far in advance of Vermont (18) and Maine (14); Michigan (25) below Minnesota (54); Kansas and Nebraska (5 each) following Colorado (9), and even New Brunswick, Alabama, Florida, Texas, and West Virginia (7 each). Kentucky (31) surpasses Iowa (25), and Indiana (39) lags far behind Illinois (69). An examination of the list on the basis of population would, no doubt, prove interesting.

How old may a newspaper be and still be a newspaper? This question has been up for decision before the secretary of the treasury, and it has been decided that a newspaper ceases to be a newspaper when it has another beside it. One newspaper is a newspaper: two or more newspapers sewed together are not newspapers, but form a book, 'at least printed matter.' All this means that a New-York importer desired, as his customers most certainly desire, that some bound volumes of periodicals should be admitted free of duty as periodicals, as, according to the last laws, the importer thought they should be. But no: the decision has come down, that "it is fair to hold it was this fresh and concurrent statement [which character it loses 'when kept for a year, and then fastened up with its fellows'] that congress meant should go free, and not (so far as news is concerned) the stale sheets, the accumulation of the year." Cannot all who may be affected, as are all readers of foreign journals, bestir themselves to prevent such needless restrictions of their rights!

The particular volumes upon which duties were called for in this case, were bound volumes of the *Annales de dermatologie* and *Annales des maladies de l'oreille*, — books which do not enter into competition with any produced in America, and which never can. If one wants a number or volume of either of these *annales*, he must have it, and nothing else will do; and no reproduction is possible, on account of the limited demand. We have, then, one more decision which interferes with American students, makes their work the more expensive, and in no possible way can benefit the American book-maker. Congress had granted a little relief, but that little has been made less by a thoughtless decision of the treasury. We say 'thoughtless;' because it is known to but few, outside those immediately interested, that the apparatus and books used by the scientific men of America *must* to a large extent be bought where they are principally produced, in Europe; reproduction being out of the question, both on account of the limited demand, and, in case of apparatus, on account of an instrument being to some extent a work of art which only one man may be capable of bringing forth.

The great question of our time is, How shall we better our methods of education? The main efforts to this end seem to be to better the system. The real need is of better teachers, not more painstaking or devoted teachers, for in these regards there is little to be desired; but, as a class, our teachers are men and women whose opportunities of culture, whose means of obtaining a broad view of the subjects they teach, are deplorably small. Year by year the number of those who go to the teacher's work from any thing like a university training become relatively fewer. The normal school is, unfortunately, taking the place of the university as the place of training for instructors in the primary and secondary schools. These institutions are admirably contrived to serve the immediate ends they seek to attain: they make business-like but slenderly provided instructors, who do their routine work better than those bred in schools of broad learning, but who miss the best that a liberal training has to give. The normal school is fixed in our American system certainly for fifty years to come. The practical question is, What can be done to lift their work to a higher level?

There are two ways of doing this, each of which seems worthy of debate. One is to move the normal schools to the seats of good universities, and mingle the university teaching with the strictly technical instruction in pedagogics. The very presence at a university will give a lift to the ideals of the pupils in the normal school. It will cost a penny more to train the youth than it does at present, but this is not a question of pennies. Nobody reckons pennies in war; and this work of education is the eternal war of mankind. Another, cheaper, less effective, but still possibly useful plan is to give the normal-school teachers an occasional year of residence at a university, where they may for a time pursue knowledge for its own sake, and widen their views of their great work. Harvard university now allows its teachers one year in seven for private study. The state could afford to do as well by its normal-school teachers. If we lift the grade of our teachers, the 'system' will take care of itself.

The government printing-office has recently issued a catalogue of the aquatic mammals exhibited by the national museum at the great international fisheries exhibition in London last year. It consists of a general account of the more interesting seals and whales of our coast, with a briefly annotated list of all the species exhibited, and is prepared by Mr. F. W. True. It detracts very much from its value that it was not printed, and ready for sale or distribution, at the time of the exhibition. To appear now, when the collection is shipped to another continent, seems somewhat of a farce, as its whole value now lies in what it contains *apart* from the collection. Either we should revise our dilatory, and at the end hasty, legislation in

such matters, or the exhibiting departments of the government will be forced to the necessity (to do proper credit to themselves) of maintaining exhibition series, which, with slight modifications for special occasions, may be kept at hand, to send wherever and whenever required. If we are rightly informed, the national museum has already decided on some such step; and, if international exhibitions are to be a yearly occurrence, the museum should add to its staff a special exhibitionary force, and not weaken its efficiency for its proper work by these constant extra draughts upon its energy.

LETTERS TO THE EDITOR.

Classification of the Mollusca.

IN Mr. Dall's kindly notice of the article 'Mollusca' in the 'Encyclopaedia Britannica,' published in your journal of June 13, he attributes to me "the erroneous statement that the radula of Glossophora is horny," and adds that 'it is really chitinous.' In the ordinary sense of the word 'horny,' chitin is (I venture to think) correctly described as horny. That the radula is generally considered to consist of the chemical body known as chitin is distinctly stated in the article criticised by Mr. Dall. At the bottom of p. 460 occur the words, 'a chitinous band (the radula).' I should be glad to know if Mr. Dall has undertaken any special chemical analysis of the substance of the radula (1).

With regard to the very general presence of jaws in glossophorous Mollusca, I must maintain my statement. The presence of a calcareous impregnation is, it is true, not usual, but exceptional (2).

Mr. Dall is mistaken in supposing that I have followed Macdonald in regard to formulae for the teeth of the radula. The other writers whom he cites as not followed are precisely those from whom my statements on the details of this subject were drawn (3).

I have no fault to find with Mr. Dall for differing from me as to certain points of classification, but I should be glad to know his *grounds* for regarding the Zygobranchia as an artificial group. He merely reasserts the old view, which I think I have sufficiently shown to be untenable (4). Mr. Dall also asserts that the orders of Lipocephala, based on the characters of the adductor muscles, are defunct. In spite of this opinion, the muscles themselves still exist, and, in my opinion, furnish indications of natural and important divergent groups among the bivalves (5).

I should be glad to know on what grounds Mr. Dall considers the three divisions of Lipocephala adopted by me to be unnatural.

Lastly, let me say that I do not know on what authority Mr. Dall asserts that the calcareous developments of the integument in Chaetoderma and Neomenia have no relation to the shells of Chiton. That they also represent or replace the spines of Chitons is sufficiently obvious. But what is to prevent our conceiving of the epidermic shelly plate of a Chiton as originally developed by the gradual coalescence of a number of small calcareous denticles, in the same way as the mesodermic dermal bones of bony fishes have developed from the shagreen denticles of the sharks (6)?

E. RAY LANKESTER.

University college, London,
July 23.

(1) Not being an organic chemist, I have not attempted analyses, but have tested many radulae with one result, — the cutting points of the teeth are always, and the whole radula generally, of a substance allied to chitin. The very generally erroneous statements in the text-books led to the criticism of the language of Professor Lankester as tending to continue the confusion. Chitin is surely as different chemically from horn as bone is, and it cannot be desirable to continue to treat the two substances in a way to perpetuate an error. Further data on this topic may be found in the August *Naturalist*, pp. 776–778.

(2) I should be grateful to Professor Lankester for the name of any recent mollusk having a 'shelly' or even a partially 'calcified' jaw.

(3) The formulae given for the teeth, and the method used in making a formula, as inferred from the text, which were the particular details criticised, are partly incorrect. I was wrong, however, in assigning a source to them. One (for instance, Patella vulgata) has the formula 3+3+1+3+3, instead of 3.1.4.1.3. No mollusk has more than one median tooth; and the central figure of the formula must in all cases be 1 or 0. I find the erroneous formula in Sars's text, though he figures the teeth correctly. Again: Chiton stelleri has, like all Chitons hitherto examined, the formula 6+2+1+2+6, instead of 0000.1.1.1.0000, which is given; but this is doubtless copied from some other authority. However, accurate formulae for the Chitons and Limpets have been accessible for some years. Again: the teeth of the radula are divided by nearly all modern students of that organ into rhachidian or median, lateral, and uncinal teeth, — three series which have anatomical relations to the radula, which are usually pretty clear. For 'lateral' Professor Lankester substitutes the term 'admedian,' which is not, as far as I know, in use; and for the 'uncini' he adopts the term 'laterals,' which I venture to think is undesirable as leading to confusion, and not in accord with general usage.

(4) The grounds on which I sustain the generally accepted views of malacologists, as to the relations of the groups Professor Lankester has compounded into the order Zygobranchia, are, that the mere abortion of one of a pair of organs is not a character of ordinal value; nor are the characters assigned to Zygobranchia applicable to all its members. Moreover, I am of the opinion that the characters which unite the Rhipidoglossa among themselves and the Docoglossa among themselves are of higher systematic value than the characters here relied upon for dismembering them. I believe, that, had the learned professor made researches among a large number of these forms, he would probably be of this opinion also.

(5) The characters of the adductor muscles, as long as we were ignorant of intermediate forms, seemed to afford a good basis for orders in the Lipocephala. Now that we know of forms which are more or less intermediate, in the Pectinidae, Ostraeidae, Mytilidae, and other families, and that in the young (not embryonic) there are frequently two adductors discernible in supposed monomyarians, with such forms turning up as Dimya, and, more recently, Chlamydoconcha, all tending to efface the supposed definite limits between the alleged orders, it seems impos-

sible to retain these orders any longer. Stoliczka came to this view long ago, and much corroborative evidence has come to hand since. In fact, there does not at present seem to be any good basis for ordinal divisions in the Lipocephala. The divisions adopted by Professor Lankester are not unnatural; but they appear to have merely an approximate value, and shade into one another to such an extent as to be of little systematic use.

(6) There is nothing to prevent any such conception; but, unfortunately, there is no evidence, as yet, that it would conform to any subjective reality. A parallel statement would be, that the wool on a ewe 'replaces' the horns on a ram. We can conceive that woolly or hairy secretions may be so modified as to produce horns, and, in fact, do produce them occasionally. The importance of the shell-gland in the embryonic condition of the Mollusca, as shown by Professor Lankester, than whom none have contributed more valuable investigations on this topic, forbids that we should consider these secondary cuticular products as its equivalent. That they are nothing less than identical with Chiton spines will, I think, be admitted by any one who compares the figures of Reincke and Hubrecht on Chitons and Neomenia respectively. There are also a great variety of other Chiton spines; and on some Fissurellidae, and even in some brachiopods, analogous structures may be found.

In conclusion, Mr. Editor, permit me to express the hope that these more or less unimportant defects in detail, which are inevitable to all work of a general character, may not obscure what I have endeavored to state clearly (namely, the great value and usefulness of Professor Lankester's work), nor delay what I believe will be its eventual consequence, — an important reformation in our general molluscan systems.

W. H. DALL.

The earthquake of Aug. 10.

It is a little remarkable that the earthquake-shock of yesterday should have been felt with considerable force in the city of New Haven, which is built upon a sandy plain, while it was perceptible only as a short series of lateral vibrations, lasting about a second and a half, and so slight that it was unnoticed by most persons in the vicinity of the observatory. The observatory is built on a sandstone ledge, and is about a hundred and fifty feet above tide-water, in (geodetic) longitude west 72° 55′ 19.15″, and latitude north 41° 19′ 28.48″.

At the time of the vibration the writer was sitting at a table, and its probable origin at once occurred to him. Allowing for the few seconds occupied in taking out his watch, the tremor occurred at 2 h. 7 m. 25 s.; and, as the watch at that time was 1.5 s. slow of the fifth hour west from Greenwich local mean time, the tremor may be set down as beginning at 2 h. 7 m. 27 s. by this mean time; and I should estimate the uncertainty at not more than 2 s.

LEONARD WALDO.

Yale college observatory, Aug 11.

On Sunday, Aug. 10, at 2 h. 8 m., I felt an earthquake, lasting three or four seconds. The oscillatory movement was from a little south of west, toward a little north of east. The oscillations were rapid but slight, with maximum intensity between the first and second second, when the movement began gradually to decrease. The accompanying sound was like the rumble of artillery-wagons. JULES MARCOU.

Cambridge, Aug. 10.

EPIDEMIC CHOLERA AND INFECTIOUS DISEASES.

THE presence of cholera this summer in epidemic form in southern France, the appearance of sporadic cases at widely scattered places and on shipboard at various seaports of the European continent and of England, have brought western civilization once more face to face with two of the most important problems which modern science and social organization can be called upon to solve. These problems just now come home to every one, but in ordinary years are put out of mind, or left to the care of laboratory devotees, or of officials charged with departments concerned with public hygiene.

The first involves a purely scientific question as to the causes, modes of origin, and ways of propagation, of the infectious or so-called zymotic diseases: the second, evolving itself naturally from the first, is of a more immediately practical nature, and deals with the processes best calculated to prevent and antagonize these diseases, especially when presenting themselves as epidemics. And these problems owe this much to such epidemics, — that by them men as individuals, and governments (their representatives), are stimulated to a vigor of inquiry and action which are never evoked by a customary rate of mortality, however high, from endemic diseases, such as are always with us; just as the stimulus of prospective want often meets with a ready response where chronic destitution makes an ineffectual appeal to action. Typhoid-fever, resembling cholera very much in its propagation, demands a steady toll from the populations of Europe and North America, compared to which the occasional ravages of cholera become insignificant; and yet it is impossible to inspire them with an intelligent dread of that enemy expressing itself in possible and comparatively simple precautions. The self-reliant Anglo-Saxon continues to regard typhoid-fever with a measure of the same indifference felt by the fatalist of India toward cholera; and the explanation is to be found,

we believe, largely in association, and not merely in the fact that fifty per cent of those attacked with the latter disease die, whereas about eighty-five per cent of typhoid-fever cases survive. The typhoid sufferer, as a survivor even, is robbed far more ruthlessly of time and strength, which by the Anglo-Saxon are transformed into wealth, which to him is life.

By this seeming digression we would impress upon readers, begging them to keep it steadily before themselves and their public authorities, the fact that cholera is but one form under which these great general problems of the cause and prevention of infectious diseases present themselves. The prevalence of cholera in France gives the health evangelist in the United States, who might otherwise continue crying in the wilderness, at once a text and a hearing, from which those who have come out from their usual routine must not be allowed to depart without a resolve to amend their ways, even though they escape this especial visitation. This threatening of cholera should be the spur to animate northern zeal for the solution of these problems which the south so often finds in the proximity of yellow-fever.

It now seems quite possible that the United States may escape, at least this year, an invasion of epidemic cholera; but if so, the reprieve should be used to perfect precautions and vigilance against next year, and to collate, as far as may be, the latest scientific investigations with previous observation and experience. *Science* has already published, either in full or in abstract, the seven reports to the German government emanating from the cholera commission under Dr. Koch in Egypt and in India. These, in giving in a somewhat popular form the results of studies of the fresh excreta of forty cholera patients and of the cadavers of fifty-two recent victims, offer an interesting and doubtless valuable contribution to the subject under discussion, but by no means demonstrate that the active principle of cholera resides in a microbion, or that the particular microbion has been discovered.

Notwithstanding the labors and advances in this direction during the last ten or twelve years, the number of diseases in regard to which a positive affirmation can be made that they are caused by a micro-organism, and by a specific micro-organism, is still very small, and neither cholera nor typhoid-fever can as yet be included in that number. The number in regard to which there is only a strong probability that they result from a specific germ, propagating amid favorable surroundings, and finding entrance to the system of the victim under favorable circumstances, is much larger, and must still be regarded as embracing cholera.

The investigations of the German commission will probably be continued under the auspices of the German health bureau at Berlin, or otherwise; and the British government has at last appointed a commission, consisting of Drs. Klein and Heneage Gibbes, to go to India and pursue this inquiry as to the nature of cholera: so that a further elucidation of the subject, and of the precise significance of Koch's observations, may reasonably be anticipated at no distant day. In the mean time it is our duty to protest against a confident application to the disease itself of measures of prophylaxis, of treatment, of disinfection, or of quarantine, based upon the life-history of the *comma-tipped bacillus*, or upon its behavior when subjected to the action of certain media or of certain germicides.

Although their specific microbions have not been definitely demonstrated, experience and observation have fairly established the probable accuracy of certain views in regard to both typhoid-fever and cholera; and upon these the measures to be adopted against such maladies are at present to be based. They are clearly and concisely set forth in a circular entitled 'Suggestions relative to epidemic cholera,' lately issued by the Massachusetts board of health, itself following generally a previous circular emanating a year ago last June from the English local government board, and reprinted under the same authority, with other supporting papers, last July.

AMERICAN APPLIANCES FOR DEEP-SEA INVESTIGATION. — THE DREDGES.

THE use of dredges for obtaining marine specimens is said to have been suggested by the common oyster-dredge, — a one-sided contrivance, well adapted for the shallow oyster-banks, on which it is skilfully handled by the oyster-fishermen of both Europe and America. This dredge possesses only a single narrow, hoe-like, scraping edge, attached to a light frame above, furnished with rigid handles. The net has a coarse mesh of stout twine, or small interlacing iron rings, the two materials being often combined. This net is too coarse to retain the finer objects, which are as important to the naturalist as the larger; and in even moderate depths there is constant danger of the frame capsizing in its descent through the water.

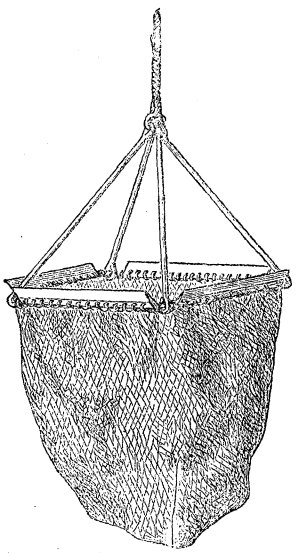

FIG. 1. — OTHO FREDERICK MÜLLER'S DREDGE, A.D. 1750.
(*From 'The depths of the sea,' p. 239.*)

It was these imperfections in the oyster-dredges, unsuiting them for careful work, that led to the changes in the shape of the frame and in the construction of the net, resulting in the production of the perfect yet simple appliance which is now used with as much precision in the deepest parts of the ocean as is the oyster-dredge in its few fathoms of water.

The ordinary dredge.

The dredges adopted by the U. S. fish-commission in 1871, and still employed for all ordinary kinds of work, are of the Ball pattern, but slightly modified. The same pattern has also been used to some extent by the U. S. coast-survey.

The fish-commission dredges are made in two sizes, — the smaller, called the 'boat-dredge,' being suitable for moderate depths of water from small boats, where only hand-power is available for the hauling-in; and the larger, termed the 'deep-sea dredge,' for vessels supplied with steam-hoisting engines. Otherwise than in size, however, these two dredges do not differ from one another. In the deep-sea pattern (fig. 2), the mouth-frame, which is constructed of the best quality of wrought-iron, measures two feet long by five and a half or six inches wide between the hinder edges of the scrapers which form the longer sides of the frame. The latter are two and three-fourths inches wide and a half-inch thick, being bevelled to a sharp edge in front, and are joined to the rounded end-pieces at an obtuse angle, which causes them to flare forward, — an essential feature for most kinds of dredging-work in which it is required that the scrapers should have a strong tendency to dig into, or 'nip,' the bottom. The handles are of round iron, bent double, as shown in the figure, with a loop at the outer end for the attachment of the drag-rope, the lower ends making a single turn about the end-pieces of the frame, upon which the handles move freely.

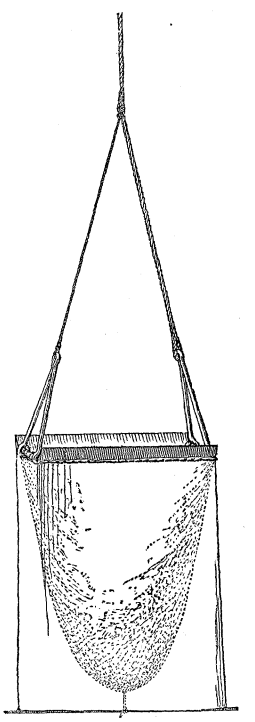

FIG. 2. — THE NATURALISTS' DEEP-SEA DREDGE AS RIGGED BY THE U. S. FISH-COMMISSION.

The net is either a closed bag of strong twine netting, having a finer mesh at the bottom than at the sides, or is made cylindrical in shape, of webbing having three or four meshes to the linear inch, the lower end being tied with a stout cord when in use. To protect the net from wear on rough bottoms, and prevent its bursting open when heavily loaded, it is covered with a bottomless canvas bag a few inches longer than the net itself. To the lower end of this bag and to the end of the net a small round stick is fastened. This is intended to prevent the fouling of the net while being lowered, and also to aid in reversing and emptying it after it has been hauled back upon the deck. It is purposely made of soft wood, in order that it may break without tearing the net if it becomes caught upon the bottom.

The drag-rope proper is tied directly to one handle only, but is connected with the other by means of a rope of much smaller size, which, in case of fouling on rocky bottom, will be the first to part, enabling the dredge to be brought up sidewise, a not unfrequent occurrence.

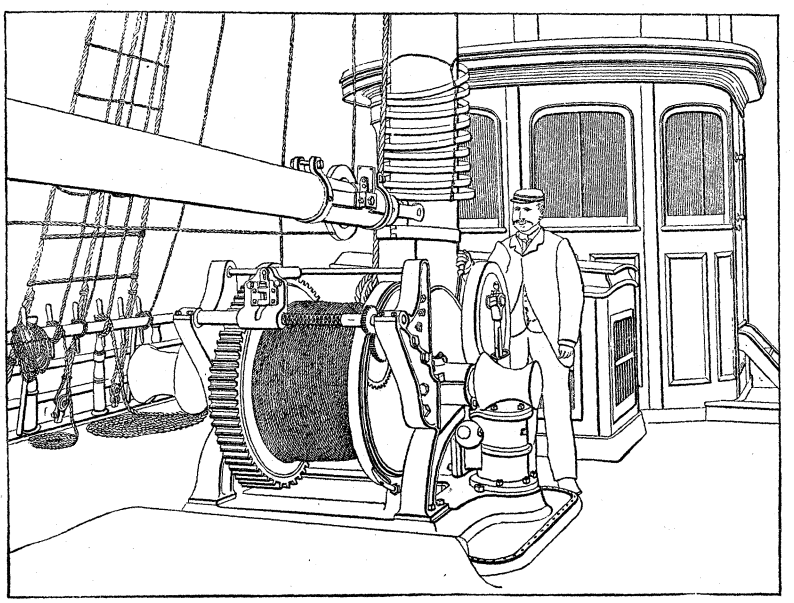

FIG. 3. — THE HOISTING AND REELING ENGINE OF THE U.S. FISH-COMMISSION STEAMER FISH HAWK, SHOWING THE SUPPLY OF WIRE ROPE COILED UPON THE DRUM. VIEW FROM FORWARD, LOOKING AFT.

Such, in brief, is the construction of the most important dredging-appliance of the past, and one which will undoubtedly be continued in use as long as marine explorations are carried on. For all the ordinary purposes of dredging, especially in moderate depths of water, it answers every requirement; its flaring mouth causing it to dig slightly into sandy and muddy bottoms which are not too soft, and to scrape thoroughly over those of rock when not too ragged. It is also cheaply constructed, and therefore within the means of private individuals.

The dredges used by the English Porcupine and Challenger expeditions were of the same pattern, though somewhat more complicated in construction, and much larger and heavier. Judging from the reports of Sir Wyville Thomson, we are also led to believe that they gave much less satisfaction than our own; and, although many of their apparent faults were acknowledged by the director in his 'Depths of the sea,' no very great improvements are noted in the narrative of the Challenger voyage. All of the changes made by these two important expeditions were apparently in the direction of increasing or lessening the

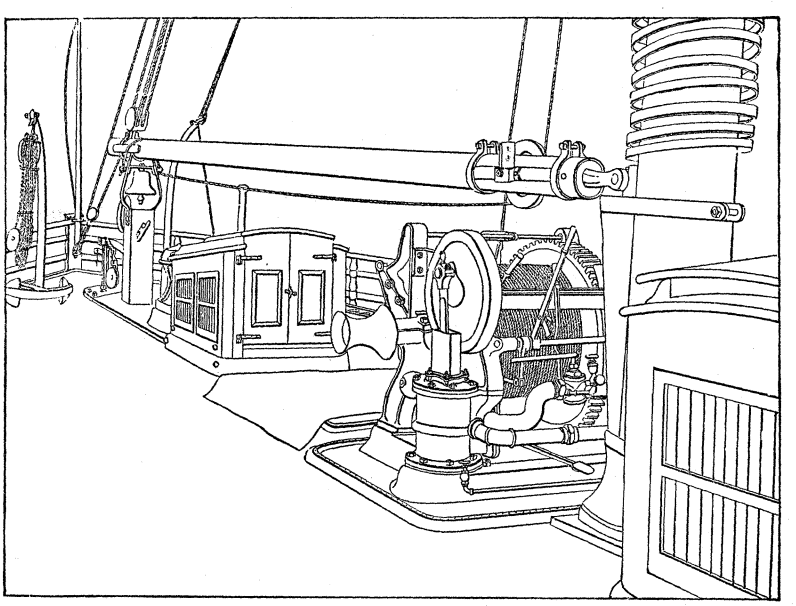

FIG. 4. — THE FORWARD DECK OF THE U. S. FISH-COMMISSION STEAMER FISH HAWK, LOOKING FORWARD FROM THE PILOT-HOUSE, SHOWING THE HOISTING AND REELING ENGINE AND THE DREDGING-BOOM.

weight of the frame, and varying its proportions of length and breadth, the same general shape being always retained. The handles were modified in different ways, and several tangle-swabs were generally attached to the hinder end of the bag.

The Porcupine dredges weighed from a hundred and fifty to two hundred and twenty-five pounds, and the frames were in some cases four and a half feet long. Discussing their merits, Sir Wyville Thomson states, that in many instances he had evidence "that the dredge, instead of falling upon the surface, and then gliding along and gathering the loose things in its path, has fallen upon its mouth, and dug into the tenacious mud, thereby clogging itself so as to admit but little more. I mean to try the experiment of heavier weights and lighter dredge-frames in the Challenger, and I believe it will be an improvement."

It was the fault here mentioned that suggested the construction of the Blake dredge described below, and which is now used by both the coast-survey and fish-commission for the muddy bottoms of deep water.

The Challenger dredge (fig. 6), as figured in the first volume of 'The Atlantic,' was an elaborate affair; and much rigidity was given to the entire appliance by two iron bars extending back, one on either side, from the mouth-frame to an iron crossbar behind the net. This cross-bar afforded attachment for tangle-swabs and weights, when such were desirable; but its main object, in connection with the lateral bars and three loopings about the net, was to keep the latter distended, and prevent its folding over the mouth of the dredge.

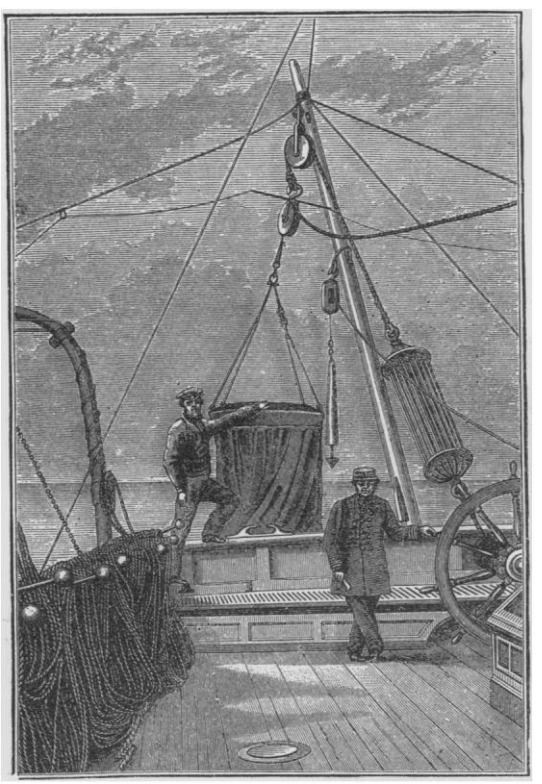

FIG. 5.—THE DREDGING ARRANGEMENTS AT THE STERN OF THE BRITISH SHIP PORCUPINE, SHOWING THE ACCUMULATOR, THE DREDGE, AND THE MODE OF STOWING THE ROPE ON THE 'AUNT SALLIES.'

(*From 'The depths of the sea,' p. 248.*)

We might almost be led to consider that in this device we have a faint suggestion of the more recently invented Blake dredge; yet the two differ radically in construction, and no hint is given, in connection with the former, that a framework might be so constructed as to prevent the undue digging-in of the mouth-scrapers. The dredges used by the Challenger for all excepting the greatest depths were no smaller than those of the Porcupine; the length of the frame being the same as that above given, and the width much greater (fifteen inches).

The Blake dredge.

The difficulty of obtaining good results with the common dredge, on the soft bottoms of mud and ooze which characterize the deeper waters off shore, gave rise to many experiments on the steamer Blake during her first dredging-cruise (1877–78), resulting in the construction of an entirely new pattern (fig. 7), well adapted to this kind of work. The necessity for a change in this direction is well expressed in the above quotation from Sir Wyville Thomson. The whole tendency of the flaring mouth, with so shallow a frame, is to work downwards as well as forwards; though in moderate depths this tendency may be more or less counteracted by a careful manipulation of the drag-rope. The dredge becomes clogged, and its farther progress is of no avail in collecting the objects which live upon the surface of the mud.

The first remedy tried was applied directly to the ordinary dredge, and consisted in 'stopping' a piece of two-and-a-half-inch rope around the hinder part of the frame, thereby correcting to a certain extent the unfavorable

angles of the scrapers, raising their lips, and preventing their cutting so deeply into the mud. Better results were thus obtained; but

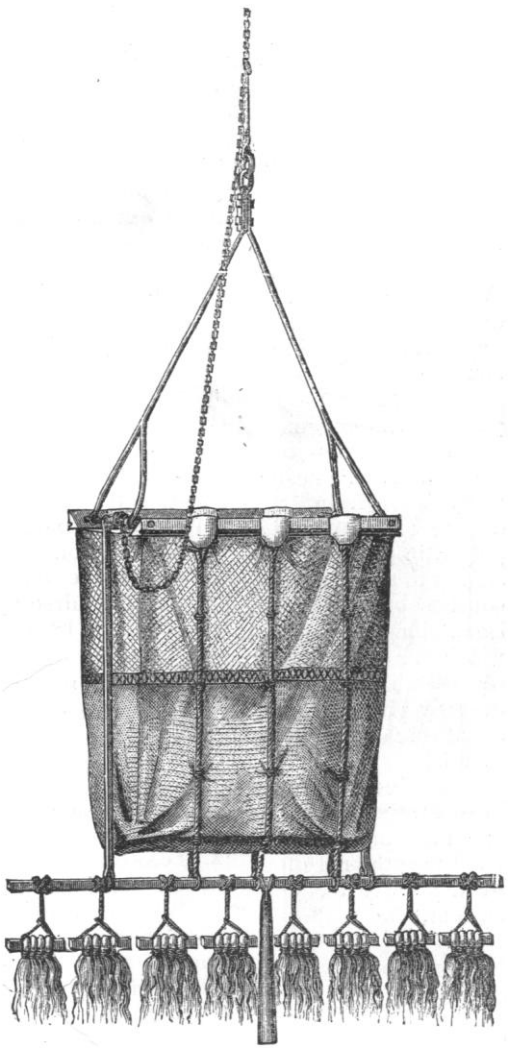

FIG. 6.—THE CHALLENGER'S DREDGE.
(*From 'The Atlantic.'*)

far better ones followed the completion of the flat frame, which was soon afterwards constructed, and used during the remainder of the cruises.

The Blake dredge, as it is called, was devised by Commander Sigsbee, U.S.N., and Master Jacoby, U.S.N.; the "object sought in the fashioning of the new dredge" having been, according to the account of Mr. Sigsbee, "to effect a skimming of the bottom rather than a deep penetration therein." Its essential features (as shown in fig. 7) are its broad, non-flaring scrapers, and rectangular iron frame or 'skeleton box' outlining its entire shape, the entire framework being rigidly joined together. These cause it to rest flat upon the bottom, and prevent its digging in beyond a slight depth. The small quantity of mud which enters at a time is being constantly washed from the net, to a greater or less extent, by the force of the water passing through it, leaving only the coarser portions and the specimens behind. When a sample of the fine bottom-material is desired, the lower part of the net is lined with some open-mesh cloth, like muslin or scrim.

The length of the frame is about four feet, the width about three feet, and the depth nine inches. The scrapers are six inches wide and three-fourths of an inch thick, being bevelled on the inner faces at the front to form sharp edges. The net, constructed of twine webbing, hangs loosely within the frame, over which a canvas covering is fastened for its protection. As used by the Blake, a transverse bar of wood or iron, for the attachment of weights and tangles, was secured to three sister-hooks at the hinder end of the frame.

This form of dredge has since been adopted by the fish-commission for deep-sea explorations, and often replaces the simple frame and net used in connection with the Chester rake-dredge described below.

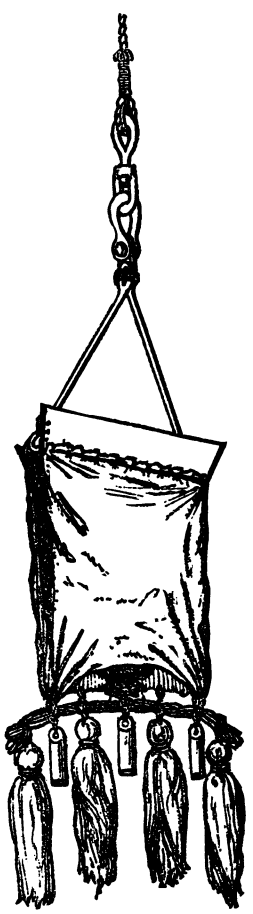

FIG. 7.—FIRST FORM OF THE BLAKE DREDGE.
(*From Sigsbee's 'Deep-sea sounding.'*)

Rake-dredges.

In 1871 Prof. A. E. Verrill, in immediate charge of the dredging operations of the U. S. fish-commission, conceived the idea of supplementing the work of the common dredge by the

use of a greatly modified form, called the rake-dredge, the object of which is to dig deeply into

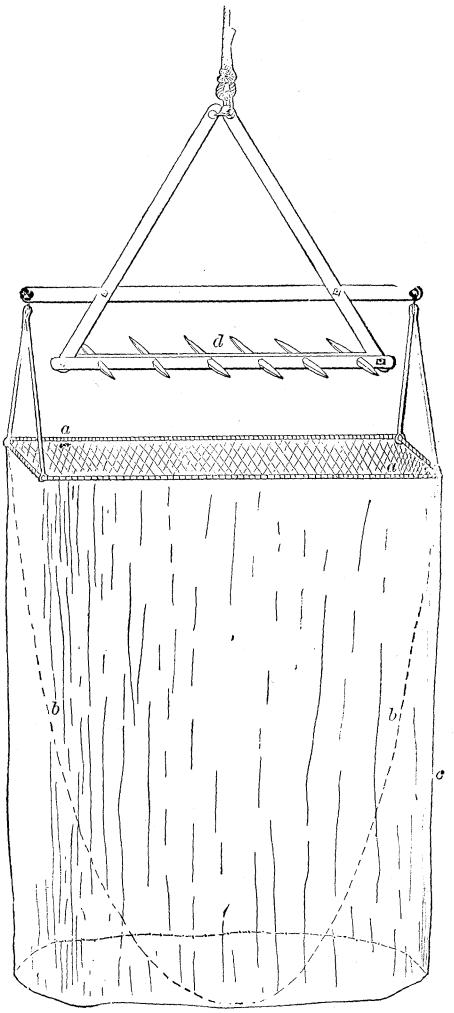

FIG. 8. — VERRILL'S RAKE-DREDGE.

the bottom, and unearth the many burrowing forms of marine invertebrates which are rarely taken in the old pattern.

This apparatus consists of a triangular frame of flat-bar iron, each side measuring forty-two inches in length. The hinder portion of the frame, which is three feet long, is constructed of two bars placed face to face, each furnished with six strong iron or steel teeth, about a foot in length, on opposite sides. These teeth, therefore, project in opposite directions; and the frame is reversible in use, working either side down. It is also so bolted together that it can be folded up for convenience in transportation. From a crossbar near the hinder end of the frame, there is suspended a capacious net, which trails behind. The mouth-frame of this net is made of round iron.

This implement, therefore, consists essentially of a large dredge, not furnished with scrapers, but preceded by a stout rake or harrow. The character of the work which it is intended to perform is obvious, and the many interesting forms which it has added to the collections of the fish-commission have caused it to be considered one of the most important additions to the dredger's outfit. It can, however, be used only on smooth muddy or sandy bottoms, and requires considerable force to drag it through compact mud or sand.

The same form of rake-dredge, without alteration or improvement, was adopted by the French exploring-steamer Talisman in 1883.

Capt. H. C. Chester of the fish-commission party devised, in 1880, a new form of rake-dredge (fig. 9), which is now generally employed in place of the old pattern. The net is similar to the one above described; but the rake consists of a heavy rectangular frame of flat iron, along the opposite and longer sides of which the teeth are arranged, projecting outwards. The rake-frame measures three feet long by nine inches wide; and the teeth are about eight inches long, stout, curved, and pointed.

The principal improvement claimed consists in separating the two rows of teeth so that the upper row may not interfere with passage backward into the net of the larger objects dug up by the lower teeth as they scrape along the bottom.

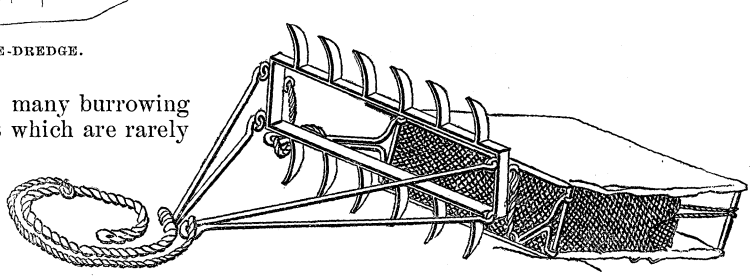

FIG. 9. — CHESTER'S RAKE-DREDGE.

An ingenious pattern of rake-dredge, intended for collecting small forms of invertebrates in shallow water, was invented in 1880 by Mr. James E. Benedict of the same party. As represented in fig. 10, it consists of a double

rake, and a cylinder of galvanized sheet-iron, thirty inches long by eleven inches in diameter, containing an elongate, tapering strainer, and supported in an iron framework having six runners of round iron at equal distances apart. The mouth is furnished with a short conical strainer of coarse wire netting projecting from the front, and a funnel-shaped collar of sheet-iron opening inwards. This dredge is designed for collecting the small, unattached forms of marine animals living upon smooth bottoms,

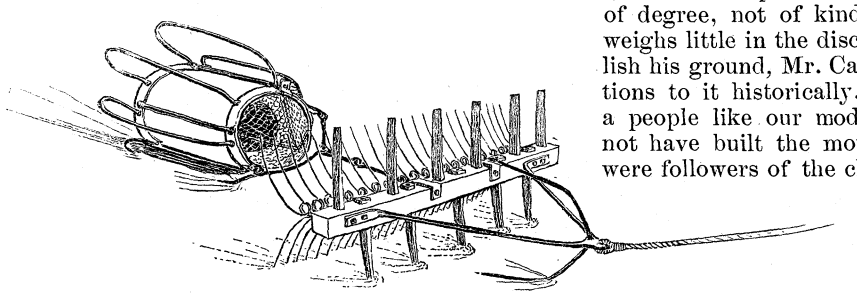

FIG. 10.—BENEDICT'S RAKE-DREDGE.

which are crushed or lost sight of in the ordinary dredges and trawls. The rake is intended to give the bottom-materials a thorough stirring up, so as to dislodge the animals, which, together with the sediment, come in contact with the nose-piece of the cylinder, only those below a certain size being able to pass in. This appliance has proved very effective in collecting in perfect condition many delicate species of animals which had previously been seldom obtained in suitable shape for study, and at the recent London fisheries exhibition it elicited much favorable comment from European naturalists.

RICHARD RATHBUN.

THE ORIGIN OF THE OHIO MOUNDS.

The mounds of the Mississippi valley historically considered. By LUCIEN CARR, assistant curator of the Peabody museum of American archaeology. [From vol. ii. of the *Memoirs of the Kentucky geological survey.* N. S. Shaler, director.] 1883. 109 p. 4°.

THE thesis which Mr. Carr has to defend in this elaborate paper is that the red Indian, as he is known historically, and without implying any lapse from a higher condition of life than he now occupies, was quite capable of building the mounds of the Mississippi valley. As we have no positive proof of what the people were who did build them, and no record of the time of building, except inferentially in some cases from the rings of trees, he claims that there is no necessity of supposing them the work of other folk than those found upon the spot by the whites at the first contact. Further, should, by any chance, evidence be found hereafter to fix the so-called mound-builder as another race, there is no ground to believe them to be higher in the social scale than the red Indian of historic times. He admits that in size the Ohio mounds, in some cases, exceed those which the Indian is actually known to have built in recent times; but in his opinion the difference is one of degree, not of kind, and accordingly weighs little in the discussion. To establish his ground, Mr. Carr meets the objections to it historically. It is urged that a people like our modern Indians could not have built the mounds, because they were followers of the chase, and not agriculturists; and without being agriculturists they could not have supplied the subsistence for the large number of men necessary to erect these mounds. There are two ways of answering this proposition. One is by asserting that there is no evidence that the building was done in such a way as to require much labor in a short time; while it may be believed that the labor was extended over a long time, and hence required few workers at any one time. This answer Mr. Carr ignores. The other reply is, that it is an unfounded assumption to affirm that the red Indian was not an agriculturist, when it is susceptible of proof that he not only supplied from the fields daily wants, but laid in store for unfruitful years and for barter. This position Mr. Carr abundantly sustains from the older writers.

The second proposition which he meets sets forth the so-called mound-builders as worshippers of the sun, and their structures as inferentially allied with that cult; while the Indian is not and was not such a worshipper. His answer to this is, that the red Indian is, and particularly was, a sun-worshipper; and this he establishes satisfactorily from the early chroniclers. Further, it is a mere assumption, in his opinion, to call a certain class of these mounds religious while there is no proof of it. The truth seems to be, that designations of convenience have grown to be arguments obscuring the question.

Having thus in two sections of his paper proved that the Indian could have built such

works if he would, Mr. Carr next undertakes to show that the Indian is known within historic times to have built similar though smaller works. Arraying a mass of testimony from the old and even later writers, sufficient in quality and quantity, he succeeds in doing this.

There is one natural objection to his conclusion. While some, or most it may be, of existing mounds should be traced to early generations of the red Indian, or of races on his plane, he does not admit that it is supposable that another race, possibly of higher grade, may have built other of the mounds.

We suspect that the truth of this last proposition is to rest on other investigations than Mr. Carr has yet touched. Manifestly, that the Indian could have built the mounds does not prove that he did; and, even if it be proved that some of the mounds in question can be directly traced to him, it does not follow that others may not have been built by a different people, since mound-building cannot be confined historically to any single people or any single continent.

Perhaps Mr. Carr has thrown the burden of proof upon the opposers of his theory, since it may be fair to argue that there is no necessity of supposing another race to account for the mounds. Granting that Mr. Carr establishes his point from the external evidences of the mounds, there yet remains a test for his theory in the contents of the mounds. Mr. Carr acknowledges this shortcoming of his argument, and promises in due time to examine the question from the testimony of the skulls and relics of workmanship, as well as from evidences of parallel custom, which can be drawn from the records of the exploration of the mounds. These, it seems to us, are to be the final tests. It is clear that history cannot settle the question, but archeological investigations may. We suspect that Mr. Carr wrongly estimates the comparative value of the two methods in a question of this kind. He says that the investigators who have given rise to the views which he combats have been "practical explorers, who have brought to the investigation a certain number of facts, chiefly cumulative in character, and who have not as a rule been possessed of that measure of historical information which is necessary to a correct interpretation of these facts." It is indisputable that the historical evidence accumulated by Mr. Carr may be helpful; but the fact still remains, that this evidence must be viewed in the light of the archeological results. It may be safe to grant all that these historical evidences prove; but arguments respecting the origin of the mounds, based on them, become inferential, and may or may not accord with the archeological demonstrations. There can be no question which is to be the ultimate tribunal.

SIDGWICK ON FALLACIES.

Fallacies: a view of logic from the practical side. By ALFRED SIDGWICK, Berkeley fellow of the Owens college, Manchester. New York, *Appleton*, 1884. (International scientific series.) 16+375 p. 16°.

IT does not often fall to the lot of a reviewer to find so little to praise in a book by so clever a writer and clear-headed a logician as the author of the treatise on fallacies, which has appeared in the International scientific series. What most obviously calls for complaint is its want of adaptation to the main purpose for which, by its publication in this series, and by the explicit avowal of the author in his preface, it seems to have been designed; namely, to be of profit to the general reader. No reader who has not become familiar with the technical language of logicians, and even with many phases of logical controversy, is at all likely to follow our author with sufficient interest to so much as comprehend what he is talking about, much less to carry away a clear and lasting impression of important truths. Not that much knowledge of logic is presupposed; but the discussion is so full of abstractions and subtleties, of nice distinctions which we are presently told are no distinctions at all, and identifications of things we had supposed very unlike and which we are presently told we would better keep apart as of old, that if we add to the intangibility of such questions the difficulty, for novices in logic, of promptly seizing the precise force of the terms which are necessarily employed, we cannot expect any very valuable results from their perusal of the book before us.

But, in point of fact, it is not to tyros only that the book will be a disappointment. There is much balancing of views on nice points of language, and every now and then a most refreshing bit of sarcasm, for our author has a keen eye for all sorts of logical weakness; and there is often plain talk about the practical limitations to which we are subject in the search for truth. But there is an extraordinary absence of decision and concentrated statement, — qualities indispensable to the success of a work of this kind. On almost every point the author comes to the conclusion that little or nothing which is useful can be said about it. With

this conclusion we are not prepared to express a disagreement; but we feel quite convinced of the unprofitableness of reading three or four hundred pages of particularly uninteresting matter to arrive at it.

There are two reasons why it seems especially ungracious to speak so slightingly of the value of Mr. Sidgwick's book. In the first place, almost every page bears evidence of the author's logical power and literary cleverness; and many passages are really good and valuable. There is an excellent chapter on the burden of proof; the remarks on the variation in the meaning of words, and many other detached discussions, are admirable; and the author is always refreshingly severe on the subject of baseless metaphysical speculation. It is pleasant, too, to come upon such human, unscholastic ways of putting things as we are frequently treated to. Thus, on p. 128: —

"For, besides the real danger of platitude, there is an opposite danger to be avoided; namely, that of unduly and vexatiously stopping an argument to have the terms explained. Without wishing exactly to defend those who made Socrates drink poison, one still cannot help recognizing that there is a limit, beyond which the laudable desire for definiteness loses its value, and becomes a hindrance and a snare. There is something so fatally easy in the attitude of a sceptic or mere questioner. Any child can keep demanding explanations, any man sufficiently stubborn can delay the most important truth by pretending not to understand its import. An obstructive policy of this kind requires no great intellectual power; and, when adopted solely for obstructive purposes, it demands, as much as any thing, a rule of urgency. Life is not long enough for exhaustive explanations."

And on p. 289: —

"Nothing could well be more confusing than an attempt to apply the cumbrous machinery of the syllogism to arguments met with in real life. And whoever has tampered with his mother-wit by substituting for it a clumsy logic depending on elaborate mnemonics, must, no doubt, pay the penalty in loss of power, so long as the mischief remains."

In speaking of the methods of induction, as stated by Mill, the author judiciously remarks, —

"Since there may possibly be, in some quarters, a disposition to take these methods for more than they were probably intended to be worth, there will perhaps be some use in reminding the reader that it is the guarding against the danger to which each method is liable, that is in every case the all-important circumstance, far more so than the mere employment of this or the other method."

And a clever hit is made in introducing these methods: —

"While, as their author himself (and more lately, Professor Jevons) expended labor in showing, none of these is, except in an ideal sense, completely satisfactory" . . .

The other reason for one's dislike to condemn the book as a whole is, that the author's faults are so largely the *défauts de ses qualités*. His mind is so open to every argument that can be urged on either side of a question, that he finds it much harder than ordinary mortals do to come to a decision; and he is so conscientious in his attempt to tell the reader the whole truth, that he gives some measure of approval to any view that has the least proportion of truth in it. This scrupulousness is most annoying and obstructive when he deals with the definitions of his terms. Here we have to watch a long process of painful labor, sometimes over very simple matters, almost always with very little result. It is, of course, a vulgar error to suppose that a scientific definition ought to be so framed that no doubt can arise as to any individual case being comprehended under it. Scientific men well understand by this time, that, however we may frame our definition, there will always be a strip, more or less narrow, of debatable ground along the boundary. But Mr. Sidgwick is alone, we may hope, in going a step farther, and carefully making his boundary run in such a way that the debatable ground shall be co-extensive with the whole territory. This peculiar excess of refinement, which so often interferes with the effectiveness of our author's work, strongly reminds one of two recent important works on ethics and economics, and almost demands the coining of the adjective 'Sidgwickian' to describe it.

Of logical errors there are few, if any, in the book; but the author occasionally illustrates his own doctrine of the difficulty of establishing a charge of fallacy, due to one's inability to know how a given argument was intended to be understood by its proposer. Thus, in the quotation discussed on p. 259, *et seq.*, we can but regard the criticism as captious. If the passage is an example of false analogy at all, it is so in a very mild degree; nor are the two examples on p. 264 strikingly in point, if at all. And this leads us to mention one final criticism on the work, in so far as it is intended to be practically useful. There are very few illustrative examples, and a notable absence of any discussion of the fallacies which have actually played a part in the history of intellectual progress. The author does not familiarize the reader with the dangers of fallacious reasoning by concrete instances, or stimulate his interest by pointed discussions involving the applications of principles rather than the principles themselves. It would be time to write a book in the spirit of this one, when everybody had

become as good a scientific thinker as Faraday or Darwin; but to-day, while fallacies of the crudest kind are rampant in every field of discussion, from religion and party-politics to biology and political economy, something less ethereal and impalpable than this statement of the necessity of philosophic doubt would have been far more useful.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Academy of natural sciences, Philadelphia.

July 8. — Professor Angelo Heilprin described a new trilobite from Walpack Ridge, about ten miles north of the Delaware Water-Gap. The tail-piece, which was the only part of the animal found, indicated an individual some six or seven inches or more in length, and clearly demonstrated its relationship to the genus Phacops, sub-genus Dalmania. Among its faunal associates were Phacops Logani, P. (Dalmania) pleuroptyx, Acidaspis tubercularus, Spirifer macropleura, Atrypa reticularis, Strophomena punctulifera, S. rhomboidalis, Orthis subcarinata (or O. multistriata?), Merista sp., etc. The horizon is that known as the Stormville shales (lower Helderberg), evidently the equivalent of the Delthyris shales of the New-York geologists.

Philosophical society, Washington.

April 26. — Prof. J. R. Eastman reported the discovery of a mass of meteoric iron at Grand Rapids, Mich. An analysis by Dr. F. W. Taylor gave: iron, 94.54; nickel, 3.81; cobalt, 2.40; insoluble, about .10; total, 100.85; specific gravity, 7.53. —— Mr. William H. Dall read a paper entitled 'Certain appendages of the Mollusca.' —— Mr. J. S. Diller read a communication on the volcanic sand which fell at Unalashka, Oct. 20, 1883, and some considerations concerning its composition. The substance of this communication has already appeared in *Science*. There ensued a general discussion of the nature and properties of volcanic dust, and of the theory which ascribes recent peculiar meteorologic phenomena to the dust ejected from Krakatoa. Capt. C. E. Dutton argued that the formation of volcanic dust particles by the bursting of bubbles tends to give them a somewhat definite general size, and does not produce a large amount of dust fine enough for indefinite suspension. The opposite view was maintained by Prof. H. M. Paul, and was sustained by Mr. Diller, who said that the microscope revealed no limit to the fineness of the Krakatoan dust. The higher the magnifying-power applied, the greater the number of particles visible; and this relation extends to the limits afforded by the capacity of the instrument. Professor Paul thought the violence of the Krakatoan explosion was competent to charge the atmosphere at very great altitudes, and considered the fineness of the dust a sufficient explanation of its indefinite suspension. Mr. William B. Taylor suggested that electricity might be an efficient cause of suspension. It is a common phenomenon of volcanic eruption; and dust particles charged with the same kind of electricity as the earth would be repelled not only by one another, but by the earth. The period elapsing between sunset and the red afterglow testifies to the great altitude of the phenomenon; and at such altitude the air is not only very rare, but is anhydrous, and the discharge of electricity is impossible.

May 10. — Mr. G. H. Williams of Johns Hopkins university addressed the society on the methods of modern petrography, classifying them as chemical, mechanical, optical, and thermal, and explaining their several functions. —— There followed a symposium on the question, 'What is a glacier?' Mr. I. C. Russell defined a glacier as an ice-body originating from the consolidation of snow in regions where the secular accumulation exceeds the loss by melting and evaporation (that is, above the snow-line), and flowing to regions where loss exceeds supply (that is, below the snow-line). Mr. S. F. Emmons defined it as a river of ice, possessed, like an aqueous river, of movement and of plasticity. In virtue of plasticity, it adapts itself to the form of its bed. The *névé* field is the reservoir from which it derives its supply of ice, and the initial impulse of movement. Until the *névé* moves from its wide and shallow bed into a narrower and deeper one, and thus gives outward proof of the plasticity of the ice of which it is composed, it does not become a glacier. It may become crevassed, and it may carry blocks of rock on its surface without losing its *névé* character. Mr. W. J. McGee said that the phenomena of glacier ice and *névé* belong to a graduating series, and can be only arbitrarily discriminated. He regarded as artificial and incompetent, classifications depending on acclivity of the ice-bed, on constriction of the ice-body, on ability to sustain bowlders, and on rate of motion. All things considered, the most satisfactory line of demarkation is the snow-line. Mr. William H. Dall discriminated masses of ice moving in a definite direction from fields of ice practically stationary, restricting the term 'glacier' to the former. A glacier is a mass of ice with definite lateral limits, with motion in a definite direction, and originating from the compacting of snow by pressure. Prof. T. C. Chamberlin said that the subject illustrated the fact that hard and fast lines belong only to nomenclature, whereas nature is characterized by gradations. The true distinction in this case is not structural, but genetic. There is an area of growth and an area of waste to every glacier. It is only superficially that the area of growth coincides with the *névé*, and the *névé* field is accurately defined only on the summer day of maximum waste. Capt. C. E. Dutton said that his intended remarks had been anticipated by Professor Chamberlin. Definition can

rarely or never be made rigorous. Glaciers vary in their characteristics like other groups of phenomena. While those features which characterize them are present, there is no difficulty of recognition; but exceptional cases arise in which a portion only of the diagnostic features are present, and persons who desire extreme precision of language are then compelled to hesitate. The difficulty is probably best met by the use of qualifying terms.

NOTES AND NEWS.

FELLOWS of the American association for the advancement of science, who may desire to avail themselves of the privileges of honorary membership of the British association, and to attend the Montreal meeting, will be furnished with the usual 'travelling certificates' on application to Mr. J. D. Crawford, post-office box 147, Montreal, Canada. These certificates should enable the fellow to purchase conveyance for himself to and from Montreal at reduced rates.

— In regard to the phosphorescence of jelly-fish, R. Meldola writes to *Nature*, that the conclusions arrived at by Mr. Verrill (*Science*, July 4, p. 8) cannot fail to be of interest to all who have ever speculated on the significance of the luminosity displayed by so many Acalephae, Medusae, and other marine organisms. When in the tropics, in 1875, very similar ideas occurred to Mr. Meldola; and in an address on the phenomena of cyclical propagation, delivered to the Essex field-club on Jan. 28, 1882, he ventured to put forward the following views: "It was in the Bay of Bengal, when on the eclipse expedition of 1875, that I first saw shoals of Medusae in their full splendor. Speculating on the meaning of the vivid colors and brilliant phosphorescence of these creatures, I came to the conclusion that both these characters might be protective danger-signals of the same nature, and fulfilling the same function, as the bright colors of distasteful caterpillars according to Wallace's well-known theory, or the phosphorescence of the Lampyridae according to Thomas Belt ('Naturalist in Nicaragua,' p. 320). The 'urticating' powers of the jelly-fish would certainly make them unpleasant, if not absolutely dangerous to predatory fish, and their bright colors and luminosity at night may thus be true warning characters."

— A joint convention was recently held by the council and past presidents of the British institutions of civil engineers, mechanical engineers, and naval architects, and of the Iron and steel institute, and the Society of telegraph engineers and electricians, to take steps toward the erection of a memorial to the late Sir William Siemens. At a meeting held on June 28, it was reported that the authorities of Westminster Abbey would be pleased to permit the introduction of a memorial window in honor of the distinguished physicist and engineer. The cost was estimated at from seven hundred to eight hundred pounds. The proposal was accepted; and it was decided to limit subscriptions to one guinea each, and to receive them only from members of one of these five societies, of all of which the deceased was a member. Subscriptions are payable to Mr. James Forrest, secretary of the Institution of civil engineers.

— Dr. Asa Gray's 'Flora of North America,' part ii. (Caprifoliaceae–Compositae inclusive), is at length issued. It contains 474 pages, mainly devoted to Compositae, which number 1,610 species arranged in 237 genera. For the convenience of distant botanists, it is sent by mail, free of postage, to those who remit the price ($5), and order it of the curator of Harvard university herbarium, Cambridge, Mass.

— In September next a geographical professorship will be established at each of the Russian universities. In Germany, fourteen out of twenty-one universities have a chair of this sort.

— Lessar is again in the Seraks country, and will explore the middle part of the region watered by the Murghâb River, which has never been visited by Europeans.

— The international society for the cure of ophthalmia offers a gold medal for the best essay on diseases of the eye. The medal is designed by Hartzes of Berlin, and bears a portrait of Albrecht von Graefe.

— In Russia the statistics of the last thirty years show a great diminution in the forest-trees, but scantily replaced by the planting of firs, as there is no supervision of forests: there is said to be a consequent change for the worse in the climate, and diminution of fruitfulness, especially in the districts round Nishni Novgorod and Moscow. In the Moscow government, which used to be rich in fruit-bearing trees, apples and cherries have much decreased in number, and pears have wholly disappeared.

— A new fog-horn, invented by Mr. Bryceson, has recently been tried on the Thames by the representatives of the admiralty. It is in the form of a pump, and is worked by a strap fastened to the signalman's foot, and so worked as to produce short or long sounds, as required. The advantages of the invention are, the length of time to which the sound can be drawn out, its cheapness, and the fact that it can be heard for three-quarters of a nautical mile in stormy weather.

— The vertical camera, for use in photographing natural-history objects, is described in a pamphlet, "La photographie appliquée aux sciences biologiques et le physiographie universel," by Dr. A.-L. Donnadieu, and published at Lyon by J.-B. Carpentier.

— In the *Monthly notices* of the Royal astronomical society for May, appears a paper by Professor Hall, upon the motion of Hyperion, the satellite of Saturn just outside of Titan, and whose motion is greatly perturbed by the latter, both on account of its mass, and the nearness and eccentricity of Hyperion's orbit. The mean motion of Hyperion is still somewhat uncertain, from the fact that there are no systematic observations of it since those of Lassel in 1852, until Professor Hall took up the systematic observation of

Saturn's satellites in 1875, upon taking charge of the great Washington refractor. This ignorance of the exact value of the mean motion is especially unfortunate in the case of Hyperion, from the fact that four times this motion very nearly equals three times that of its disturbing giant neighbor, Titan; in which case the perturbations become very large, or, in case this relation is an exact one, the theory of their motions is very greatly modified. Until, then, the lapse of time and continued observation shall show how much the quantity $4n-3n'$ differs from zero, it is Professor Hall's opinion that it will be useless to attempt the complete theory of Hyperion's motion.

To show something of the rapid changes in the elements of the orbit due to the great perturbations going on, Professor Hall has discussed the observations of each year separately, assuming a value of the inclination and longitude of node determined beforehand from his earlier observations, — which quantities are very little disturbed, — and by least squares has deduced for each year, including Lassel's 1852 observations, values of the semi-major axis, eccentricity, and longitude of peri-Saturnium for Hyperion. The most remarkable feature of the results is the rapid retrograde motion of the peri-Saturnium, amounting to about 20° per year for the epoch 1875-77, but apparently diminishing quite rapidly. This motion is comparable with the rapid retrogression of the moon's nodes; but it would seem to be rather irregular, unless the printed annual values of P are liable to considerable uncertainty. Professor Hall calls attention to the desirability and importance of re-reducing Lassel's observations, and publishing them more in detail.

— *Insecten-börse* is the title of an advertising fortnightly sheet just started in Leipzig for the benefit of collectors, dealers, and amateurs in entomology. The first number, composed of four quarto pages, contains a surprising variety and number of objects for sale.

— A blue grotto, similar to that of Capri, has been found on the Island of Busi, off the coast of Dalmatia. It is formed by three connected grottos, which can only be approached from the sea. It is highly vaulted, and is only lighted through an opening under the sea; this causing the glorious reflected blue light.

— It is proposed to hold a special American exhibition in London in May, 1886, at which the products, manufactures, and varied phases of life in the United States, will be represented.

— We learn from *Nature* that Prof. R. S. Ball has accepted an invitation from the Lowell institute, Boston, to give a course of six lectures on 'Chapters in modern astronomy' next October.

— A German expedition has been despatched to Cape Town in the corvette Elizabeth. It is fitted out by the firm of Lüderitz of Bremen, and will afterwards proceed to Angra Pequena. The leader of the expedition is Lieut. Siegmund Israels, a Hamburger, who served in the English army during the Ashantee war. An engineer has been engaged from Düsseldorf, who will use his experience in the service of a Westphalian firm of iron founders.

— We learn from Germany, that the Italian geologists have written to the president of the international geological congress at Berlin, asking that the intended meeting of September next be postponed to another year, on account of the cholera, and the quarantine imposed at the boundary of several kingdoms in Europe. Later information is, that the congress will be postponed to September, 1885, not only on account of the cholera, but also on account of the number of members drawn off to America by the meeting of the British association. It is also stated that the reports of several of the committees could not be ready this year.

— A hypsometric chart of European Russia, prepared by Gen. Tillo, has been published at the expense of the ministry of public works. The altitudes of more than 18,000 points are indicated on this chart, of which 12,000 were trigonometrically fixed, 4,000 determined by levelling, and only 400 rest upon barometric observations. More than 1,500 mean heights for the level of the water at points on various rivers are also included. The chart is accompanied by an explanatory memoir.

— Prof. George H. Darwin of Trinity college, Cambridge, is now in this country, and has lately married a Philadelphia lady, Miss Maud Dupuy. He returns to England after the conclusion of the meeting of the British association for the advancement of science at Montreal.

— *Apropos* of the distinction which has lately fallen to Professor Roscoe of Manchester, — a knighthood conferred by the queen in consideration of his services in connection with the technical education commission, — the London *Academy* calls to mind the fact that he affords a fine example of the union of the qualities needed by the successful investigator with those of a good man of business; and that his popular sympathies have won him the warm regard of the Lancashire workingmen, among whom the study of science is more common than might be supposed.

— According to the *Personal-verzeichniss der Universität Leipzig für das summer semester*, 1884, there are, in all, 3,160 students at the university, of whom 608 are studying medicine, 99 pharmacy, 232 natural science (*naturwissenschaften*), and 137 mathematics. There are 41 Americans at the university, of whom 7 are studying science. Three of the whole number of students were matriculated as early as 1878, and 33 more in 1879. Dr. Caspar Renè Gregory of Philadelphia has just been appointed privat-docent in the theological faculty in recognition of his researches in textual criticism.

— The following societies will be represented at Philadelphia, in addition to those already mentioned (*Science*, iv. 140): Geological survey of India, Theo. Hughes Hughes (deputy superintendent); Belfast natural-history and philosophical society, Messrs. James Musgrave, Henry Musgrave; Linnean society, Messrs. John Ball, A. W. Bennett, W. Carruthers, C. Delaune, Howard Saunders, and Dr. James Murie.